

REMARKS

Summary

Applicants request favorable reconsideration and allowance of the subject application during Continued Examination, in view of the preceding amendments and the following remarks.

Status of the Claims

Claims 1-34 and 45- 47 are pending. Apparatus claims 1, 17, and 45 are independent. Method claims 35-44 are cancelled, in view of the final restriction requirement and filing of Divisional application Ser. No. 11/546,974 on October 13, 2006. No new matter has been added.

Statement of Substance of Interview

The Examiner has accurately summarized a brief telephone interview, on October 11, 2006. [Paper No.20061011]. Applicant pointed out that a divisional application to non-elected method claims would be filed, and that the SET Technology of the present invention was viewed to be a distinct and definite field of invention, that was not a “mere intended use” of any type of pipe connection. Applicant referred back to the June 13, 2006 Response, wherein both structural as well as functional differences had been pointed out between the present invention and the connections disclosed in Smith et al (5,505,502). Smith et al. was characterized as a connection to be threaded on already “expanded” pipes that really would not be expanded afterwards, in contrast to current SET technology. The Examiner noted his view that it was not possible to limit claim structure by reference to any expansion that would be imposed upon the structure in the field, for example. No experimental results were offered or described, and no particular exhibit was offered or discussed. No claim amendments were offered, and no agreements were reached.

Requested Action

Continued examination of amended claims Claims 1-34 and 45- 47, in view of amendments and associated remarks that point out both functional limitations on the claimed structure, and structural differences that are not present in the cited prior art.

In that regard, applicant respectfully advances as controlling the legal position that, in light of the specification, the phrase “a radially expandable threaded tubular assembly to be radially expanded after connection to define oilfield tubular goods” is a valid and clear limiting restriction on the nature of the assembly structure which follows, and a limitation that would be understood by workers in this field as meaning an improved joint which has been specially adapted or configured for use with modern SET (Solid Expandable Tubulars) technology.

The claims as amended fairly convey and recite a very particular purpose, and materials that are structurally characterized as to characteristics, to manifestly further particularize and define the structural attributes of interrelated components. MPEP §2173.05 (g) reminds that there is nothing wrong with defining some part of an invention in functional terms, and all such limitations need to be considered. *See, e.g., K-2 Corp. v. Salomon S.A.*, 191 F.3d 1356, 1363, 52 USPQ2d 1001, 1004 (Fed. Cir. 1999) (“The functional language is, of course, an additional limitation in the claim.”) *See, also, Intel Corp. v. U.S. International Trade Commission*, [948 F2D 821] 948 F.2d 821, 832, 20 USPQ2d 1161, 1171 (Fed Cir. 1991) (interpreting functional language in an apparatus claim as requiring that an accused apparatus actually possess the *capability* of performing the recited *function*)

The presently amended claims, therefore, cannot be viewed as a structurally complete invention within the claim body wherein a preamble only serves to state a purpose or one of several intended uses for the invention, so that the preamble is not really a claim limitation. *Compare, Rowe v. Dror*, [112 F3D 473] 112 F.3d 473, 478, 42 USPQ2d 1550, 1553 (Fed.Cir. 1997).

Substantive Final Rejection

Claims 1-16, 45 and 46 were finally rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,505,502 Smith et al. (“Smith et al ‘502”) in view of applicant’s own citation of a 2282 Thiokol High Performance Polysulfide Joint Sealant document. (“Thiokol 2282”). Claims 17-34 and 47 likewise were finally rejected under 35 U.S.C. §103(a) as being unpatentable over Smith et al ‘502 in view of U.S. Patent No. 3,822,902 to Maurer et al. (“Maurer et al ‘902”).

Response to the Substantive Rejection

Applicants submit that the present inventions, as recited in independent claims 1, 17, and 45, are not obvious because there has been no fair recognition of the nature of the claimed structure, and there is no true teaching reference for the particular invention being claimed.

When a SET pipe expansion process is produced inside a connection threaded on a pipe end there are several things to be considered.

First, from a structural perspective, it is necessary to perform this expansion as smooth as possible aiming to avoid the rupture of the string at any of the weakest points, such as the connection or the interface of a pipe and a connection. Recall that it is also important to use strings with constant or almost constant stiffness all along the length of the string. Therefore, it is necessary to provide a nearly constant profile of the string with no sudden changes in wall thicknesses, since it is well-known that changing thicknesses causes localized stresses. These localized stresses could lead to a failure in the transition area when subjected to high tensile loads like those observed during the expansion process.

Secondly, from a sealability point of view, it is mandatory that the connection maintain sealing integrity even after being radially expanded. The shrinking reaction tends to force both the male and the female members of the connection to be separated from each other. Hence, it is necessary to provide a way of maintaining both members together while being expanded and then to remain together after the expansion.

The expandable connection object of the invention is a connection able to be expanded after being assembled as it is deemed necessary in accordance to the SET technology. According to this SET Technology the connection is assembled and run into the well and further expanded inside the well. In order to do this in a safely manner the stiffness of the system connection/pipe should be of the same order all along the string without abrupt changes in the wall thicknesses prior to expanding. In the oil and gas industry the connection that in the assembled condition has a wall thickness – defined as the difference between the external diameter and the internal diameter of the connection divided by two - equal to those wall thicknesses of the adjacent pipe sections is called “flush” connection or “flush” joint.

Those connections protected by both Smith et al ‘502 and Maurer et al are connections threaded on already “expanded” pipes with low or no possibility of being expanded afterwards as requested by SET technology. In the oil and gas industry the connections protected by Smith et al ‘502 and Maurer et al ‘902 are called “upset” connections.

Tests Relating To The Feature of an Expandable Sealant

The connection described and claimed herein does not employ sliding metal-metal seals or an elastomeric O-ring seal as in the 1993 teachings of Smith et al. ‘502. Only applicants teach an SET type of sealing mechanism provided by an elastomeric sealant or cold welded soft metals which are suitable for expansion by a mandrel after being assembled.

Likewise, the metal coatings illustrated within the 1972, alleged “secondary teachings” of Maurer et al ‘902 are irrelevant because they do not address requirements of a SET joint. Maurer et al ‘902 disclose a heavy upset connection with a seal ring and a groove to avoid high pressure inside the connection and make reference to the use of thread lubricant (zinc base or lead base) to prevent galling (col.4, lines 10-17).

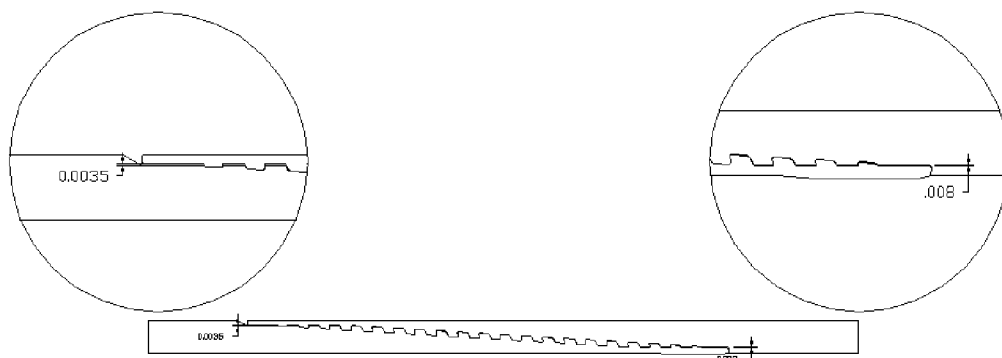
Applicants exclude use of any separate thread lubricant in between the coated surfaces as such could prevent the same from being cold-welded. Applicants have plainly taught that both members must be threaded and engaged to form a cold welding upon expansion, to create a strong connection. The cold welding process between

metallic coatings taught only by the present invention is needed for joining SET expandable pipes, and a viscous lubricant would destroy that weld.

Concerning the use of a polysulfide for the application as considered to be obvious, the Applicants respectfully disagree with the Examiner's position. Though the material safety datasheets of this type of sealants mention that the same are considered "flexible sealants" Applicants believe there is no teaching about why or how to extrapolate from problems associated with a typical threaded connection to the very different SET connection recited as the invention. There is no doubt that Thiokol merely suggests a use of this sealant for a simple caulking.

There are well known drawbacks to using a caulking compound sealant with any threaded connection, which essentially render non-obvious an application of a particular sealants for the present type of SET connection. The drawbacks can be summarized as follows:

Gaps: The gaps that are left for any type of lubricant, sealant, substances in general when these threaded connections are made-up are smaller than that it is recommended by the manufacturer of these sealants. For instance, for a connection size of 5 ½" [ref drawings RD-XP-5500-17B and RD-XP-5500-17B] the gaps would be as shown below, being a maximum of 0.008 inches in the radial direction.



PICTURE 1

It is also well-known that manufacturers do not recommend these products for

joints less than ¼” in width or depth [ref Technical datasheet PSI 270/RC Multicomponent Polyurethane Reservoir Sealant and/ or Syntacalk GC2+ Specification Data Sheet].

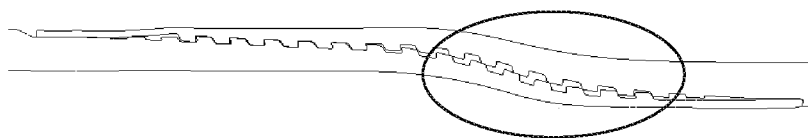
The design of the invention was optimized to allow an acceptable behavior of the sealant, while the distribution had to be optimized based on the volume to be occupied after the radial expansion from within, as the final step in modern SET make-up procedure.

In addition the capacity of these sealants to stand the claimed loads typically also must be tested [ref ASTM D429-02a Method A and ASTM D-412 Method A]. Such tests measure the adhesion the rigid substrates and provide data about elongation and tensile resistance. Hence, for a SET application, there are unpredictable requirements and workers do not expect any mere ‘sealant’ to be useful.

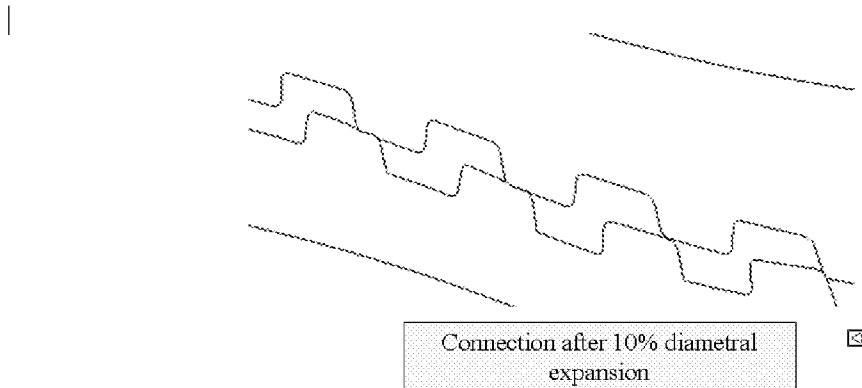
Lack of lubrication: The Examiner has posited that it is obvious to use coatings applied on each member to avoid galling. “Galling” is a major concern for connections to be used in the oil and gas industry. In order to avoid an undesirable outcome after assembling the connection the use of lubricants has been considered an imperative. Having said that, the use of any member of the class of elastomeric sealants would be taught away from. Note the specification herein points out that in the context of the present invention none of the datasheets for the elastomeric coatings described at ¶57 [page 6] claim any lubrication properties.

Furthermore, in the context of the present invention it is disclosed that the elastomeric sealant be “greaseless” as it is necessary for the sealant not to slip during the expansion process.

The following picture is a numeric simulation of what may happen when a given connection is expanded and slipping was allowed, due to the presence of lubricants.

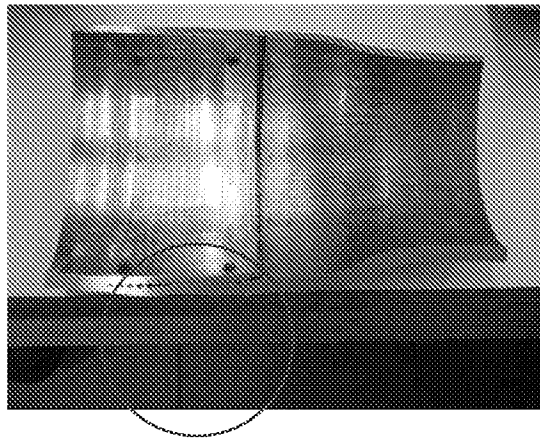


PICTURE 2



PICTURE 3

Such behavior was also observed in connections that had been assembled with thread compounds or standard thread sealants (e.g., Loctite 567) following an expansion process.



PICTURE 4

Capacity to sustain the deformation and remain adhered to the substrate: In order to validate the applicability of these sealants in the context of the present invention, it was required that the connections with any sealant be tested by performing evaluations [ref Instituto Nacional de Tecnologia Industrial – Centro de Investigación y Desarrollo Tecnológico de la Industria del Caucho (Buenos Aires, Argentina)]. Hence, workers of

ordinary skill would make no “assumptions” about the utility of any particular sealant, and instead would expect to test and analyze the obtained results that then would have to be corroborated, when the SET connections are expanded.

Hence in a SET environment, there is no factual basis for the Examiner’s position that it would have been obvious for someone with the appropriate skills “to modify Smith et al based on Maurer et al to provide a first and second coating to ensure that the threads are thoroughly lubricated to protect against galling”. The Examiner’s position might be supportable for simple standard connections. However, any typical coating used with a standard application does not at all predict or imply suitability for an expandable SET connection. In the context of the present invention, the coatings -- either metallic or elastomeric -- must be carefully evaluated and tested in order to stand the level of deformation the SET connection is subjected to.

Where a metallic coating has been used in previous applications for joining pipes, in all of those previous applications there also has been a lubricant to allow a proper assembly without damaging the connection or causing galling. In the context of the present invention, both coatings are assembled with no need of lubricants, essentially because any lubricant would act as an interface between the mating coatings and completely prevent the required cold welding. If this is the case the connection could be assembled, but with a minor expansion the male thread, the female thread or both could slip one against the other provoking the opening of the connection with a possible disassembly leading to a connection not suitable for the application, as leak paths could appear as shown above, in Pictures 2, 3 & 4.

Therefore, it is critical to appreciate that, in the context of the present invention, when the coatings are applied as specified a “cold weld” takes place between the mating members of the connection. This assures a successful assembly, and keeps the member of the connection together before, during and after the expansion making it suitable for use as an oil field tubular good, that is to say allowing fluids (oil, gas, condensed gas) to circulate internally of the string of pipes and connections. For such a cold welding the thicknesses of the coatings is optimized so that there is enough strength in the layer and in the interfaces, and additionally it should not be so thick so as to cause restrictions

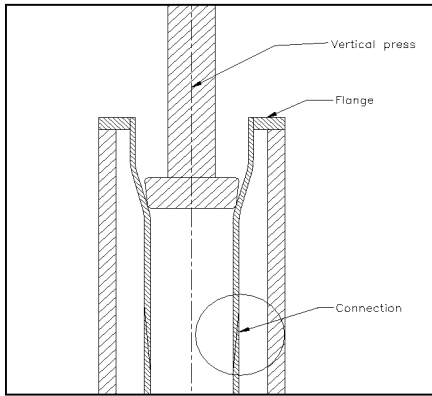
during the make-up.

The metals specified and claimed herein have certain characteristics to allow the cold welding process to happen. Not any metal will undergo a shear stress without propagating fissures or cracks. The shear stress is produced while the expansion is taking place and the threads of the pin (male) and box (female) tend to separate from each other. This feature is also helped by the low recrystallization temperature that the specified and claimed metals have, which allows them remain strain free after the expansion.

Therefore, it also is critical to appreciate that, merely selecting any metallic coatings for a SET connection to join pipes will not make accomplish the intended result - a connection both suitable to be expanded and able to remain fully fluid tight and operative after that SET expansion. The only way of guaranteeing an acceptable metal seal performance is by producing a “cold weld” which is essential for the application.

The Polyspec, Thiokol 2282 material was discovered to have acceptable characteristics for the particular SET threads of the invention, such as a minimum shear stress, only after testing done by applicants. Applicants submit that the geometry and mechanical characteristics required by claims 45, 46 are not merely data recited in the brochure being relied upon by the Examiner, and the difficulties of a SET sealing environment are also not addressed in that document.

In the case of the elastomeric sealants the same situation occurs but in this case the elastomeric sealants should resist both the expansion and they should remain attached to the substrate they were applied on. In this case different types of tests were conducted including, but not restricted to [ref ASTM D429-02a Method A] to corroborate that even with thicknesses and gaps smaller than those recommended by the manufacturers these elastomers could provide an acceptable response. Adaptability of any particular elastomer for the present invention had to be corroborated by completing a series of expansions in-house. During these expansions the connections and pipes were expanded 7% and 14% using a device for small samples which are shown schematically and its actual shape, by the pictures below (Pictures 5 & 6).



PICTURE 5



PICTURE 6

Right after these expansions the connections remain joined, i.e. assembled without showing any gaps in the threads. A picture of connections in non-expanded and expanded condition can be seen in the picture below (Picture 7)

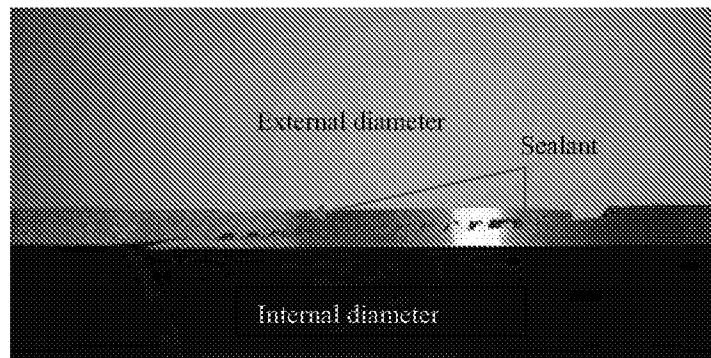
PICTURE 7 – Right: expanded connection.



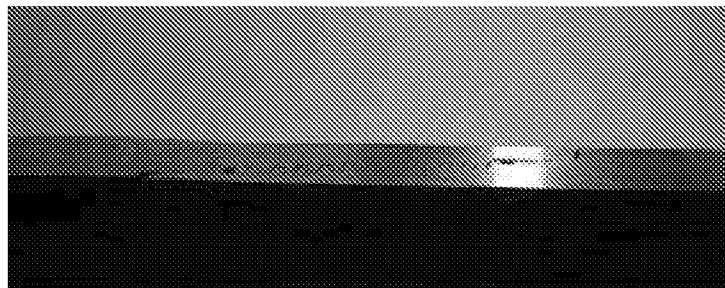
These connections were manufactured with an original external diameter of 5 ½” and tested for tightness [ref Center for Industrial Research –CINI] using water and gas following the steps:

- **Water (psi):** 0, 3000, 3500, 4000, 4500, 5000, 5500 and 6000.
- **Nitrogen (psi):** 0, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5500 and 6000
- Holding times were 10-minute long, except for the first and last steps which lasted 15minutes and 25minutes respectively.

After completing the test the connections were cut in slices so as to check the condition of the threads. Two examples of these connections can be seen in Pictures 8 and 9 below.



PICTURE 8



PICTURE 9

Note that some waves on the external diameter are produced during the SET expansion process. What it is clear in both cases is that the connection remained closed after the expansion which is completely different from what has been seen in Pictures 3 and 4.

Structural Differences between The Claims and the Prior Art

Smith et al '502 is not a true teaching reference for the invention of Independent Claim 17, which comprises a radially expandable male threaded element having external male threading and a first free end. The external male threading includes a first

incomplete thread and a first hooked thread. The first incomplete thread is located at least adjacent the first free end of the male threaded element. The assembly also comprises a radially expandable female threaded element having internal female threading and a second free end. The internal female threading includes a second incomplete thread and a second hooked thread. The second incomplete thread is located at least adjacent the second free end of the female threaded element. The assembly also comprises a first metallic coating disposed on and adhered to the external male threading, and a second metallic coating disposed on and adhered to the internal female threading. The female threaded element is threadedly engaged with the male threaded element, and the first metallic coating is cold welded to the second metallic coating

There are various other structural differences between the specified and claimed invention, and the cited prior art. In particular, Smith et al '502 make use of a connector which walls are thicker than those of the pipe sections to which the pin and box parts are connected, for example, as by welding. Hence, Smith et al '502 in fact are teaching the different structure of something "expanded"; i.e. a connector threaded on a pipe with thicker wall, and not anything that is intended to be "expandable"; i.e. with a capacity of being expanded.

Smith et al '502 illustrate thin-walled extensions or lips 31, and 35 [col 4, lines 8-30] and an o-ring 38 that can be wedged and compressed up to 25%. However, these structures very plainly are taught to be the result of a make-up torque that creates a camming seal and not an inner, radial expansion arising from use of a separate inner SET mandrel or the like tool. Note also that even mere inner fluid pressure is said to be able to flex the lip 31, outward. [col 5 lines 13-26].

Applicants specifically disclosed in the present application, at ¶55, that the chemistry illustrated by the Thiokol 2282 brand was one example of a preferred class of greaseless sealants, useful according to principles of the present invention. However, nothing within the four corners of the specification of Thiokol 2282 suggests that it would have utility according to the particularly claimed SET geometry that is defined by the claims. Only a complete hindsight reconstruction using applicant's specification as the true teaching reference is available to make that leap.

Maurer et al '902 is a 1972 patent that has nothing to do with SET technology and therefore categorically is irrelevant and cannot be relied upon as a secondary reference that would teach one of ordinary skill about some "obvious" modification to the 1993, alleged teaching reference of Smith et al '502, in order to produce the particular and novel SET improvements being claimed.

Applicants, in their September 6, 2005 Request For Reconsideration, at page 4, pointed out in detail that Royal Dutch Shell may have begun to work on concepts underlying Solid Expandable Tubular (SET) Technology as early as 1993, however, the first connection suitable for a true SET application was not developed until about 1999.

Hence, workers of ordinary skill as of November, 2003, when the present application was filed, will correctly understand the present claims as a radially expandable threaded tubular assembly to be radially expanded from within after connection to define oilfield tubular goods, or apparatus configured solely for use with an inner tool inside of oilwell tubular goods in order to radially deform a solid string formed by pipes and connections wherein to expand the external diameter.

Workers of ordinary skill as of November, 2003, when the present application was filed, also will correctly understand the present claims as an apparatus configured for being cold-worked, in order to create a steel pipe resulting in a pipe with a larger diameter. The recited structure also recognizes the need to react to such deformation which creates a shrinking or "spring-back" effect towards the inside diameter of the pipe. This effect exists all along the pipe but it is particularly severe on the free ends of the pipe as there is nothing there to restrain such a movement.

Smith et al '502 merely describes a connector (box and pin) joined to pipes, for instance by welding them, where the walls of such connector are thicker than the pipes that such pins and boxes are connected to. Smith et al '502 illustrates connectors which have two metal seals as well as an elastomeric seal with two thread load relief grooves, formed by two mating threaded surfaces, one with a male (pin) thread and the other with a female (box) thread. The metal seals are located on long, unthreaded lips while the elastomeric seal is located in a groove close to the external shoulder of the male

member.

Smith et al '502 do not disclose any incomplete threads adjacent a free end, but instead an elongated extension or lip, 31, 35. Applicants have taught criticality for an overall constant diameter joint and pipe and a first incomplete thread being located at least adjacent the first free end of a male threaded element. The present application further discloses incomplete threads with a very particular geometry or shape, i.e. trimmed roots but complete crests which are critical to provide a longer contact along the threaded area and which increases the tensile resistance of the connection in comparison with the prior art.

Independent Claim Limitations

Independent apparatus Claims 1 and 17 require not only the functional limitations discussed above, but also particular limitations as to thread structure not at all found in Smith et al '502, such as:

a radially expandable male threaded element having external male threading and a first free end, the external male threading including a first incomplete thread and a first hooked thread, the first incomplete thread being located at least adjacent the first free end of said male threaded element.

Likewise, Independent method Claim 17 requires:

providing a first radially expandable tubular member having external male threading and a first free end, the external male threading including a first incomplete thread and a first hooked thread, the first incomplete thread being located at least adjacent the first free end of the first tubular member;

providing a second radially expandable tubular member having internal female threading and a second free end, the internal female threading including a second incomplete thread and a second hooked thread, the second incomplete thread being located at least adjacent the second free end of the second tubular member;

Likewise, Independent apparatus claim 45 requires:

a pair of radially expandable elements each having threading at a free end thereof and coupled to one another, the threading including hooked incomplete threads being located at least adjacent the free ends; and;

With respect to the “obviousness” of choosing any particular “sealant”, as recited in Claim 45 and 46, it must be emphasized that the alleged teaching reference,

Smith et al '502, does not disclose any type of thread sealant at all, just three mechanical seals, including sliding metal-metal contacts and a compressed O-ring. The larger diameter and very long tong surfaces 50, 51 are noted to be spaced from a "corrosion protection coating" on the pipe surfaces 22, 23 but no manner of thread sealant is mentioned. Perhaps, a lubricant would be used during the assemblage, but the two metal seals and the O-ring are taught to be required to provide the sealing mechanism. Additionally, a standard viscous, API thread dope would not be suitable for SET type expandable connections as it cannot stand the forces which result from the expansion process.

Smith et al. '502 represents an approach taken by Royal Dutch Shell, in 1993. Later disclosures by Shell that are more specific to modern SET techniques include US Pat. No. 6,604,763 B1, which likewise illustrates that Shell has taught away from any manner of a greaseless polymer or flowable sealant, in favor of solid rubber O-rings that deform elastically upon an expansion.

Another basic fact makes the 1993 vintage connection disclosed by Smith et al. '502 not comparable to the one described herein. Smith et al. '502 is a connection threaded on heavy wall pipes which would present great difficulty for expansion due to the inhomogeneous distribution of wall thicknesses. Such pipe and connection geometry not only may lead to a fracture in the transition zone between the connector and the pipe, but also does not provide an appropriate solution for the drilling/completion problems that are identified herein.

Likewise, despite the allegations of the Examiner, Smith et al '502 is not a true teaching reference for the invention of Independent Claim 45, which comprises an expandable sealed tubular joint with a pair of radially expandable elements each having threading at a free end thereof and coupled to one another. The threading includes hooked incomplete threads located at least adjacent the free ends. The joint also comprises a sealing substance extending between and adhering to the threading of one radially expandable element and the threading of the other radially expandable element. After a radial expansion of the coupled pair of radially expandable elements, the

sealing substance remains extended between and adhered to the threading of one radially expandable element and the threading of the other radially expandable element.

Dependent Claim Limitations

Dependent claims 2-16, 18-34, and 46-47 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. For example, neither Smith et al '502 nor Maurer et al '902 discloses a flush joint connection, as recited, for example, in dependent claims 11, 29, and 47.

The dependent claims 2-10, 18-34, and 46-47 are not obvious or the product of some routine optimizations. Applicants respectfully disagree with the unsupported contentions that Smith et al '502 or the Thiokol document or Maurer '902 can be read to teach the various and particular limitations as found in the dependent claims. As discussed above, neither Smith et al '502 nor Maurer et al '902 teach the SET environments defined in all of the dependent claims. This issue should moot in view of the discussion above regarding independent claims 1, 17, and 45.

Further individual consideration of these dependent claims is requested.

Conclusion

Applicants respectfully submit that elected claims 1-34 and 45-47 of the instant application are in condition for allowance. Favorable reconsideration, withdrawal of the rejections set forth in the above-noted Final Office Action, and an early Notice of Allowance are requested.

The undersigned attorney may be reached in our Washington, DC office by telephone at (202) 530-1010. Any petition fee required to render a response timely may be charged to our Deposit Act. No. 06-1205.

All correspondence should continue to be directed to our address given below.

Respectfully submitted

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